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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Method of Disposal of Hot Water Soluble Fabric

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ABSTRACT OF THE DISCLOSURE

A method of disposing of garments after use. The garments are provided as non-woven fabric of thermoplastic fiber, the fiber being water soluble at temperatures above approximately 30°C. After use, the fabric is subjected to water at a sufficient temperature to substantially dissolve the fabric whereupon the water and dissolved fabric are subjected to disposal.

The present invention involves a method of disposing of garments after use. Specifically, the garments are composed of non-woven fabric of thermoplastic fiber or sheets which are water soluble at temperatures above approximately normal human body temperature (37°C).

Hospital patient care generates considerable quantities of infectious medical waste in primary and acute care facilities. There has been a general conversion from reusable, cleanable items, to disposable items over the last three decades. These conversions were made to promote antiseptic techniques in patient care and to decrease the potential for cross-infections between patients, staff and the general public. Recent federal and state government regulations such as the Medical Waste Tracking Act of 1988 and OSHA Medical Facility rules have resulted in a substantial increase in medical waste that must be classified as "infectious."

When a patient is admitted to a hospital, the patient produces approximately 55 pounds of medical waste per day. Approximately 20% of this waste is infectious. The current stated objective of the American Hospital Association and the Centers for Disease Control is to treat medical waste as soon as it is generated. Both organizations recognize that medical waste is primarily an occupational hazard for health care workers and not an environmental problem. The best way to deal with infectious medical waste is to disinfect it at the point of generation and dispose of the treated medical waste with minimum handling and storage on premises.

As a result, consumption of medical disposable non-woven products has been growing at a rate of approximately 10% a year. In 1988, sales

totaled approximately 1.155 Billion Dollars. It is projected that by 1992, sales of medical disposable non-woven products will reach 1.54 Billion Dollars.

Disposable medical fabrics are generally currently composed of thermoplastic fibers such as polyethylene, polypropylene, polyamides and acrylics. These fabrics can also include mixtures of thermoset fibers such as polyimides, polyarimides and cellulosics. They are typically 10-100 grams per square yard in weight and can be thermabonded, hydroentangled, wet laid or needle punched by methods that are well known in the textile arts.

Although there is clearly a benefit in the use of disposables in the medical arts by avoiding the necessity of human contact with medical waste which is necessary in the cleaning of comparable reusables, non-biodegradable disposables are posing a problem which is only now being recognized. Landfill sites are becoming increasingly burdened with disposables which do not biodegrade for hundreds of years, if ever. As landfill sites become fully exploited, new sites must be found which are rightfully opposed by residents located proximate to proposed site locations.

It is thus an object of the present invention to provide a method of disposing of garments after use while avoiding additional burdens being placed upon landfill disposal sites.

It is yet a further object of the present invention to provide a method of disposing of garments after use such that the garment can be solubilized and medical waste substantially sterilized in a single operation.

These and further objects will be more readily appreciated with considering the following disclosure and appended claims.

The present invention involves a method of disposing of garments after use which comprises providing the garments as sheets or as non-woven fabric of thermoplastic polymer of fiber. The fiber or sheets are water soluble at temperatures above approximately the normal body temperature or approximately 37°C. The fabric composed of said fiber is subjected to water at a sufficient temperature to substantially dissolve the fabric whereupon the water and dissolved fabric or sheets are subjected to disposal.

The present invention deals with the disposal of fabric or sheets configured into such garments as drapes, towels, covers, overwraps, gowns, head coverings, face masks, shoe coverings, CSR wraps, sponges, dressings, tapes, underpads, diapers, wash cloths, sheets, pillow covers and napkins. Such products are generally employed in the medical industry both in hospitals, outpatient facilities and home environments.

Many of these products generally come into contact with human bodily fluids and their disposal and disinfection has become a matter of major concern in light of the lack of biodegradability of prior products and the potential spread of human fluid-born diseases such as hepatitis B and AIDS.

In order to cope with these difficulties, it is proposed that fabric employed in the manufacture of such items be composed of fibers or sheets which are soluble in hot aqueous baths, including water, either alone or with the addition of surfactants, salts and bleaches. Such fibers or sheets would be unsoluble in cold to warm baths preferably below 37°C, the average temperature of the human body. However, it is preferred that at or near the boiling point of water, disposal could be

accomplished in a hot water bath such as a washing machine that is dedicated solely to solubilizing and disinfecting garments made of such water soluble fabric or sheets. By employing such a method, two objectives would be accomplished, namely, that the fabric or sheets would be disinfected and would be solubilized for disposal through the sewer system. Not only would this lessen the burden now being imposed upon current landfill sites but liquid sewer disposal would prove a comparative low cost technique in ridding the user of such used garments.

Fibers or sheet materials useful in practicing the present method can comprise one or more members selected from the group consisting of partially hydrolyzed polyvinyl acetate, alginates and their salts, polymeric proteins, cellulose alkyl derivatives and polyethylene oxides. Partially hydrolyzed polyvinyl acetates leaving a considerable quantity of polyvinyl alcohol residue in their backbone are particularly useful. It is further contemplated that the ethyl, methyl and propyl alkyl derivatives of cellulose can be advantageously employed as appropriate fibers or sheets. Useful fibers are typically 0.5 denier to 5.0 denier and are preferably from 1.0-2.0 denier and most preferably sized at 1.2-1.5 denier in size. A commercially available product for use in the present invention is either type T-B (VEE 1290) or type T-5 (VPB 101) which are each available from Kuralon as its PVA fiber. This material is sold in 44mm lengths having a hot water solubility point of 30-90^{o}C. The T-B product is sized at 1.2 denier while the T-5 product is sold in 38mm staple lengths of 1.5 denier.

The sheet material can be constructed of polymers while the fabric useful in practicing the present method can be constructed by any well known

technique for making non-woven fabric. Such techniques useful in practicing the present invention include spun bonding, melt blowing or being wet laid, hydroentangled with cold water and/or thermally bonded with 50% of the surface melted to form, for example, a diamond pattern. When products, such as diapers, are configured of sheets of suitable thermoplastic material, that the sheets be approximately 1 to 6 mils in thickness and more preferably 1 to 3 mils in thickness and most preferably approximately 1.5 mils in thickness. The fabric or sheets are approximately from 20g/yd^2 to 200g/yd^2 in weight and more preferably from 30g/yd^2 to 70g/yd^2 and most preferably from 40g/yd^2 to 80g/yd^2.

As examples the following fabric samples were manufactured on conventional thermal bonding equipment.

I.D.	TL-0079.0	79.1	79.2	080.0	0080.1
Fibre	Kuralon T-5 PVA (1.5 denier, 38 mm staple length)				
Pattern No.	2	2	2	1	1
Fabric Wt. (gms/sq.yd)	27	44	47	35	43
Thickness (mil)	15	12	17	14	16
Tensiles-(Grab-lbs)					
Dry MD	8.3	11.7	16.6	13.8	16.1
Wet MD	3.2	4.8	4.6	3.1	6.0
Dry CD	2.0	2.3	4.3	3.8	5.2
Wet CD	1.0	1.5	1.7	1.3	2.3
Elongations(%)					
Dry MD	11	10	12	12	11
Dry CD	48	30	38	19	22
Mullen Burst (psi) Dry	11	15	19	13	16
Wet	10	14	19	13	15
Hanle-O-Meter (gms)	84	244	432	173	244
Trap Tear-MD	1.7	2.1	3.5	2.7	2.9
CD	0.4	0.4	0.8	0.6	0.7

It was found that the above-manufactured fabric displayed nearly identical physical properties similar fabric manufactured from polyester and polypropylene. However, the fabric manufactured above was unaffected by cool or warm water (23-37°C) but when exposed to hot water (80-90°C), immediately dissolved.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of disposing of garments after use comprising providing said garment as non-woven fabric or sheets of thermoplastic polymer or fiber, said fiber or sheets being water soluble at temperatures above approximately the normal human body temperature (37°C) and subjecting said fabric after use to water at a sufficient temperature to substantially dissolve said fabric or sheets whereupon said water and dissolved fabric or sheets are subjected to disposal.

2. The method of claim 1 wherein said fiber or sheets comprise one or more members selected from the group consisting of partially hydrolyzed polyvinyl acetate, alginates and their salts, polymeric proteins, cellulose alkyl derivatives and polyethylene oxides.

3. The method of claim 1 wherein said fiber is approximately 0.5-5.0 denier in size.

4. The method of claim 3 wherein said fiber is approximately 1.0-2.0 denier in size.

5. The method of claim 3 wherein said fiber is from approximately 1.2-1.5 denier in size.

6. The method of claim 1 wherein said fabric or sheets are prepared from said fiber by spun bonding.

7. The method of claim 1 wherein said fabric is prepared from said fiber by melt blowing.

8. The method of claim 1 wherein said fabric is prepared wet laying and hydroentangling said fiber.

9. The method of claim 1 wherein said fabric is prepared thermally bonding said fiber.

10. The method of claim 8 wherein said fiber is thermally bonded after hydroentanglement.

11. The method of claim 10 wherein approximately 50% of the fabric surface is melted by thermal bonding.

12. The method of claim 1 wherein said fabric or sheets are configured into a member selected from the group consisting of drapes, towels, covers, overwraps, gowns, head coverings, face masks, shoe coverings, CSR wraps, sponges, dressings, tapes, underpads, diapers, wash cloths, sheets, pillow covers and napkins.

13. The method of claim 1 wherein said sheets are approximately 1 to 6 mils in thickness.

14. The method of claim 1 wherein said sheets are approximately 1 to 3 mils in thickness.

15. The method of claim 1 wherein said sheets are approximately 1.5 mils in thickness.

16. The method of claim 1 wherein said sheets or fabric are approximately 20 to 200 g/yd^2 in weight.

17. The method of claim 1 wherein said sheets or fabric are approximately 30 to 70 g/yd^2 in weight.

18. The method of claim 1 wherein said sheets or fabric are approximately 40 to 60 g/yd^2 in weight.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of disposing of garments after use comprising providing said garment as non-woven fabric or sheets of thermoplastic polymer or fiber, said fiber or sheets being water soluble at temperatures above approximately the normal human body temperature (37°C) and subjecting said fabric after use to water at a sufficient temperature to substantially dissolve said fabric or sheets whereupon said water and dissolved fabric or sheets are subjected to disposal.

2. The method of claim 1 wherein said fiber or sheets comprise one or more members selected from the group consisting of partially hydrolyzed polyvinyl acetate, alginates and their salts, polymeric proteins, cellulose alkyl derivatives and polyethylene oxides.

3. The method of claim 1 wherein said fiber is approximately 0.5-5.0 denier in size.

4. The method of claim 3 wherein said fiber is approximately 1.0-2.0 denier in size.

5. The method of claim 3 wherein said fiber is from approximately 1.2-1.5 denier in size.

6. The method of claim 1 wherein said fabric or sheets are prepared from said fiber by spun bonding.

7. The method of claim 1 wherein said fabric is prepared from said fiber by melt blowing.

8. The method of claim 1 wherein said fabric is prepared wet laying and hydroentangling said fiber.

9. The method of claim 1 wherein said fabric is prepared thermally bonding said fiber.

10. The method of claim 8 wherein said fiber is thermally bonded after hydroentanglement.

11. The method of claim 10 wherein approximately 50% of the fabric surface is melted by thermal bonding.

12. The method of claim 1 wherein said fabric or sheets are configured into a member selected from the group consisting of drapes, towels, covers, overwraps, gowns, head coverings, face masks, shoe coverings, CSR wraps, sponges, dressings, tapes, underpads, diapers, wash cloths, sheets, pillow covers and napkins.

13. The method of claim 1 wherein said sheets are approximately 1 to 6 mils in thickness.

14. The method of claim 1 wherein said sheets are approximately 1 to 3 mils in thickness.

15. The method of claim 1 wherein said sheets are approximately 1 5 mils in thickness.

16. The method of claim 1 wherein said sheets or fabric are approximately 20 to 200 g/yd^2 in weight.

17. The method of claim 1 wherein said sheets or fabric are approximately 30 to 70 g/yd^2 in weight.

18. The method of claim 1 wherein said sheets or fabric are approximately 40 to 60 g/yd^2 in weight.